



Queensland University of Technology
Brisbane Australia

This is the author's version of a work that was submitted/accepted for publication in the following source:

Hamilton, Kyra, White, Katherine M., Young, Ross McD., Hawkes, Anna L., Starfelt, Louise C., & Leske, Stuart (2012) Identifying critical sun-protective beliefs among Australian adults. *Health Education Research*, 27(5), pp. 834-843.

This file was downloaded from: <http://eprints.qut.edu.au/55405/>

© Copyright 2012 The Author

Notice: *Changes introduced as a result of publishing processes such as copy-editing and formatting may not be reflected in this document. For a definitive version of this work, please refer to the published source:*

<http://dx.doi.org/10.1093/her/cys093>

Identifying critical sun-protective beliefs among Australian adults

Kyra Hamilton^{1,2}, Katherine M. White^{1,3,*}, Ross McD. Young³, Anna L. Hawkes^{4,5}, Louise C. Starfelt^{1,3} and Stuart Leske^{1,3}

1. School of Psychology and Counselling, Queensland University of Technology, Victoria Park Road, Kelvin Grove, Australia, 4059.

2. School of Applied Psychology, Griffith University, Messines Ridge Road, Mt Gravatt, 4122.

3. Institute of Health and Biomedical Innovation, Queensland University of Technology, 60 Musk Avenue, Kelvin Grove, Australia, 4059.

4. Viertel Centre for Research in Cancer Control, Cancer Council Queensland, 553 Gregory Terrace, Fortitude Valley, Brisbane, Australia, 4006.

5. School of Public Health, Queensland University of Technology, Victoria Park Road, Kelvin Grove, Australia, 4059.

*For correspondence contact: Katherine White, Queensland University of Technology School of Psychology and Counselling, Victoria Park Road, Kelvin Grove, Brisbane QLD 4059. Email: km.white@qut.edu.au

Journal: Health Education Research

Type of Contribution: Original article

Date of Preparation: 15th December 2011; Date of Revision: 2nd May 2012

Word count: Abstract: 200 words; Manuscript: 3993 words (excluding title page, abstract, references, and tables/figure)

Number of Tables: 1

Number of Figures: 1

Keywords: sun-protective behaviour, theory of planned behaviour, beliefs, adults

Abstract

We investigated critical beliefs to target in interventions aimed at improving sun-protective behaviours of Australian adults, a population at risk for skin cancer. Participants ($N = 816$) completed a Theory of Planned Behaviour belief-based questionnaire and a 1-week follow-up of sun-protective behaviour. A range of behavioural, normative, and control beliefs correlated with sun-protective behaviour, with no and only minimal differences observed in correlations between beliefs and behaviour by gender and age, respectively. A range of key beliefs made independent contributions to behaviour; however, the behavioural belief about being less likely to tan ($\beta = 0.09$); normative belief about friends ($\beta = 0.20$); and control beliefs about forgetfulness ($\beta = -0.14$), inconvenience ($\beta = -0.17$), knowing I will be in the sun for a long time ($\beta = 0.16$), and more fashionable sun-protective clothing ($\beta = 0.13$) were significant critical beliefs guiding people's sun-protective behaviour. Our study fills a gap in the literature by investigating an at-risk population for skin cancer and using an established theoretical framework to identify critical beliefs that guide Australian adults' decisions to sun protect. Attention to these critical beliefs will assist health campaigns and interventions aimed at combating the increasing rates of skin cancer for adults.

Introduction

Melanoma of the skin is the third most commonly diagnosed cancer in Australia with incidence rates expected to rise for both males (30%) and females (18%) [1]. The major cause of melanoma in Australia is exposure to ultraviolet (UV) radiation from both sunlight and solariums [1-3]. Skin cancer is largely preventable by using sun protection methods including a broad spectrum water resistant sun protection factor (SPF) 30+ sunscreen, staying in shady areas, minimising time in the sun between 10am and 3pm, and wearing sun-protective clothing [4]. Despite the risk of sun exposure without protection, sun-protective behaviour in Australian adults remains low [5] with females more likely to sun protect compared to males and adolescents and young adults less likely to use sun protection compared to both children and older adults (although the association between age and sun protection behaviour is unclear) [6]. While previous research has focused on raising awareness and knowledge about the dangers of skin cancer and measuring the adoption of sun safe practices, there is little research aimed at understanding people's decisions for engaging or not engaging in sun-protective behaviour [7].

This insight is especially timely given the significant amount of recent media attention that has been devoted to the issue of Vitamin D deficiency, sun protection, and cancer. Over a period of four years, Youl *et al.* [8] found that the percentage of adults believing that sun protection could lead to inadequate Vitamin D levels increased from 15% to 32%, with those participants who usually performed some sun safe practices most likely to have changed their behaviours with respect to Vitamin D attitudes. In addition, implicit messages about sun protection in popular Australian media which contradict public health messages concerning skin cancer prevention [9], current perceptions of sun-tanned skin as healthy [8, 10,11] and physically attractive [12] and white un-tanned skin as unhealthy and indicative of being a 'couch potato' [13,14], highlight the need to continue to study this important preventive

health behaviour. It should be noted, however, that media images of both extremes of paleness and tanness as fashion icons have been portrayed previously [9]. In a recent study, Jackson and Aiken [15] suggested that increasing the attractiveness of pale image norms (i.e., the cognitive representations of stereotypical members of particular groups perpetuated by the media) may be effective in producing sun-protective behavioural change. Similarly, Hevey et al. [16] found a significant role for individual differences in body image on behavioural intentions in relation to skin cancer. Since sun-protective behaviour depends on individual decision making processes [17], it is vital to understand people's attitudes toward, and motivations for, sun protection.

Several theoretical approaches that examine the mechanisms underpinning the decision making for health behaviour have been applied within the health domain, such as the health belief model [18], transtheoretical model [19], and social cognitive theory [20]. Although these models give some consideration to the role of benefits and barriers to performing a given behaviour, they tend to ignore the role of social influences on behavioural performance. The theory of planned behaviour (TPB; [21]), the most common decision-making model that has guided the majority of the research in the health domain [22] acknowledges the role of social influences along with advantages and barriers for behavioural performance. In addition, the TPB can help to identify critical targets for health behaviour change interventions [23,24]. The TPB suggests intention as the proximal determinant of behaviour with intentions being determined by attitudes (positive or negative evaluations of the behaviour), subjective norms (perceived pressure from others to perform the behaviour), and perceived behavioural control (PBC, perceived amount of control over behavioural performance; also believed to influence behaviour directly) [21]. An important feature of the TPB is its suggestion that the antecedents of attitude, subjective norms, and PBC are corresponding behavioural (costs and benefits), normative (others' approval/disapproval), and

control beliefs (barriers and motivators), respectively. [21]. These underlying expectancy beliefs are further thought to interact with the value one places on their beliefs.

A wide range of beliefs has been shown to influence people's sun-protective behaviours. In a recent synthesis of qualitative studies on skin protection, Garside *et al.* [25] found that covering up or wearing sunscreen was seen as a hassle. A study in Queensland, Australia (N = 890) found that, of adults who had been sunburnt in the previous week, 22.6% forgot to protect, 18% believed that the sunscreen wore off, 7% thought they didn't need to protect, 6.8% couldn't be bothered protecting, and 6.3% suggested that the sun burnt through their clothing or sunscreen [26]. Thomas *et al.* [27], using a 'message-framing' paradigm to examine sun protection behavioural intentions, found that the perceived threat of skin cancer was greater when messages focused on the disease's impact on appearance rather than health, whereas intentions to perform different sun protection behaviours (e.g., wearing protective clothing) was greater when messages were 'framed' negatively regardless of their focus. Positive attitudes toward tanning and sun bathing are also associated with a decreased likelihood of using recommended protection from the sun [28].

In addition, a number of studies have utilised the TPB [29, 30] and, more specifically, the TPB-based beliefs [31, 32] to increase our understanding of people's sun safe practices. Of the limited number of sun safety studies thus far that have employed a TPB belief base analysis, some important beliefs underlying people's cognitions have been identified. Among young Australian adults, salient advantages of sun protecting include decreasing the risk of sun burn and skin cancer, whilst common disadvantages include sun protection being uncomfortable, looking unfashionable, and being inappropriate for certain environments [32]. For these young adults, family, friends, and healthcare professionals are reported as salient normative influences, with forgetfulness, laziness, and people thinking that they won't be out in the sun reported as frequent inhibitors of sun protecting and more fashionable hats and

sun-protective clothing, access to sunscreen stations, and having cheaper sun protection products identified as common motivators [32]. There remains, however, a paucity of sun safety research in a broader adult Australian context based on well-validated theoretical models that can identify key influences impacting upon sun protection decisions among this at-risk population. This study, using a theory-based approach, will identify the critical beliefs that guide people's sun safe practices thereby offering new insights into key targets for resultant interventions to increase sun protection behaviours in a population susceptible to developing skin cancer in their lifetime.

Using the TPB as a theoretical framework, we aimed to investigate the critical beliefs that underlie people's decision making about sun protection. Critical beliefs are those that are revealed as being significantly related to, and independently influence, the target behaviour [23]. Examining beliefs that have a strong influence on a given behaviour allows for the identification of targets for a tailored intervention aimed at changing the given behaviour which, in turn, increases the potential effectiveness of a resultant intervention [23]. This identification is especially important given that evidence for interventions aimed at changing people's health behaviours have had limited effect [33], with results being largely inconsistent [34]. As belief-behaviour associations are considered fundamental in providing preliminary evidence to support the usefulness of targeting a belief in a behavioural intervention [35,36], the focus of this paper was on identifying those critical beliefs guiding Australian adults' sun protection behaviour. Given that it is suggested that the traditional value items of the TPB have a limited additional utility for belief measurement [37], we focused only on the behavioural, normative, and control expectancy beliefs. In this study we assessed beliefs relating to (i) benefits and costs of performing sun protection (behavioural beliefs), (ii) important referents' expectations of engaging in sun protection (normative

beliefs), and (iii) motivating and inhibiting factors toward practicing sun protection (control beliefs) and their relative influence on engaging in sun-protective behaviours.

Method

Design and Procedure

The University's Human Research Ethics Committee provided ethical clearance. The study employed a prospective design with two phases of data collection, 1 week apart. Participants were recruited through snowball sampling, media releases, sporting clubs, and places of employment. Data collection occurred between March and May 2011. The Time 1 main questionnaire assessed the standard TPB predictors (attitudes, subjective norm, PBC, and intention), along with the indirect TPB predictors (i.e., the underlying beliefs of attitude, subjective norm, and PBC namely behavioural, normative, and control beliefs, respectively) which are the focus of this paper. Participants completed the TPB belief-based questionnaire either on-line ($n = 775$) or in a paper-based format ($n = 41$). The Time 2 follow-up questionnaire assessed participants' self-reported sun safe behaviour over the past week. Participants completing both questionnaires were given the option to receive an AUD\$20 shopping voucher to thank them for their participation.

Participants

At Time 1 ($N = 816$), 393 males (48.2%) and 423 females (51.8%), aged between 18 and 88 years ($Median_{age} = 36$ years, $M_{age} = 39.7$ years, $SD = 15.94$ years), completed the main questionnaire. Participants lived in major cities ($n = 638$, 78.2%), inner regional ($n = 133$, 16.3%), outer regional ($n = 41$, 5%) and remote ($n = 4$, 0.5%) areas of Australia. Just over half of participants had attained a university education ($n = 450$, 55.1%). Most participants ($n = 567$, 69.5%) were employed, with the remaining participants indicating they were either unemployed ($n = 35$, 4.3%), students ($n = 169$, 20.7%), or retired ($n = 99$, 12.1%). These demographic characteristics are somewhat similar to the general Australian population.

Specifically, according to the 2006 census data [38], 68% of Australians live in major cities, 49.4% are male, and the median age is 37 years.

Participants reported spending a mean of 2.21 hours ($SD = 2.19$ hours) in the sun on a typical weekday and 4.38 hours ($SD = 3.61$ hours) in the sun over the weekend (i.e., Saturday and Sunday) in the previous week. White skin (51.8%) was the skin colour before tanning most frequently reported, followed by light brown skin (20.3%). After repeat exposure to the sun, just over half of the participants reported sunburn/sun damaged skin ($n = 453$, 55.5%). Of those who completed the main questionnaire, 71% ($n = 579$) completed the Time 2 questionnaire. Bivariate analyses with Bonferroni adjustment (to avoid chance capitalization) of the sun-protective beliefs across those respondents who did and did not complete both questionnaires revealed no differences.

Measures

The target behaviour of ‘sun safe behaviours’ was defined as using SPF30+ sunscreen, wearing protective clothing (hat, long-sleeved shirt, sunglasses), or seeking shade during the peak hours of the day (between 10am and 3pm). In line with recommendations outlined by Fishbein and Ajzen [39], items were framed to specify the target (provided for participants as defined above), action, context, and time of sun safe behaviour (e.g., “Performing sun safe behaviours every time I go out in the sun for more than 10 minutes during the next week”).

Elicitation Study. An elicitation study ($N = 42$, 19 male and 23 female; $M_{age} = 38.8$, $SD = 16$) using focus group methodology was conducted to identify the most commonly occurring behavioural, normative, and control beliefs, and other experiences related to engaging in sun-protective behaviours. The discussion guide comprised open-ended questions as outlined by Fishbein and Ajzen [39]. Focus groups were conducted to the point of theoretical saturation, where additional interviews yielded only repetitive material. Frequency

labels from Hill's Consensual Qualitative Research Approach [40] were applied to the data to identify the most common responses to each of the TPB-based questions.

Questionnaire. Based on responses from the elicitation study, questionnaire items were developed in accordance with TPB recommended methods [21]. Behavioural, normative, and control belief-based items were scored on 7-point Likert scales, scored *extremely unlikely [1] to extremely likely [7]*. Participants were asked to rate how likely each of (i) ten benefits/outcomes would occur if they performed sun-protective behaviours every time they went in the sun for more than 10 minutes during the next week (behavioural beliefs) (ii) six referents would think they should perform sun-protective behaviours every time they went in the sun for more than 10 minutes during the next week (normative beliefs) and (iii) seven inhibiting and nine facilitating factors would prevent/motivate performance of sun-protective behaviours every time they went in the sun for more than 10 minutes during the next week (control beliefs or barrier/enablers). For a full listing of belief-based items, see Table 1. The outcome measure of behaviour was tested on a single-item assessing participants' performance of sun safe behaviours in the past week ("In general, how often did you perform sun safe behaviours?", scored *Never [1] to Always [7]*).

Statistical Analysis

Guidelines as specified by von Haeften *et al.* [41] were used to identify the critical beliefs of sun-protective behaviour. First, the Pearson product-moment correlation matrix was analysed to identify those beliefs that significantly correlated with the target behaviour. As it is suggested that beliefs may differ for different populations [21] and that the sun protection behaviours between younger and older adults [6] and between the sexes may differ [6, 42], we examined also if sex and age differences in beliefs existed using Fisher Z tests. To identify those beliefs that make independent contributions to the behaviour, within each belief-based measure, the significant key beliefs were entered into a stepwise multiple

regression. As a final step, all of the key beliefs that independently contributed to the prediction of behaviour were entered into a final regression. Given that sun-protective behaviour may vary for different populations [6], to ensure the independent influence of beliefs and that the demographic factors had no undue effect on the findings of the study, a final Hierarchical Multiple Regression (HMR) analysis was undertaken with the demographic factors of age (years), gender (male vs female), time spent in sun (hours), skin type (fair skin vs moderate-dark skin), employment status (employed vs not employed), university education (university education vs non-university education), and city living (city living vs non-city living) entered as covariates at Step 1 and the critical beliefs entered at Step 2.

Results

Mean and SD for the sun protection beliefs and behaviour are presented in Table 1. As shown in Table 1, participants generally performed sun-protective behaviours at a moderate level in the past week ($M = 4.73$, $SD = 1.68$). Correlations for sun safe beliefs with behaviour for the total sample and by sex and age group are presented in Table 1. As demonstrated in this table, for the total sample of participants, the majority of the beliefs significantly correlated with behaviour. Evaluation of the correlations between sun safety beliefs and behaviour by sex suggested that none of the correlations were significantly different. In addition, evaluation of the correlations between sun safety beliefs and behaviour by younger adults (18-39 years) and older adults (40+ years) suggested that 5 out of the 32 correlations were significantly different. Given that only minimal differences between sun safety beliefs and behaviour by gender and age were observed, we regressed the significant key beliefs on behaviour for the total sample. The behavioural beliefs about decreasing the risk of sunburn ($\beta = 0.15$, $p = .001$), being uncomfortable ($\beta = -0.19$, $p = <.001$), being exposed to harmful chemicals if I use SPF30+ sunscreen ($\beta = 0.13$, $p = .002$), and being less likely to tan ($\beta = 0.10$, $p = .03$); normative belief about friends ($\beta = 0.31$, $p = <.001$); and

control beliefs about more fashionable hats and sun protective clothing ($\beta = 0.16, p = <.001$), knowing that I will be in the sun for a long time ($\beta = 0.15, p = <.001$), inconvenience ($\beta = -0.18, p = .001$), and forgetfulness ($\beta = -0.15, p = .002$), were revealed as independent predictors of sun-protective behaviour. To identify the critical targets, these 9 key beliefs were entered into a final regression analysis. Six critical beliefs were identified as independently contributing to the prediction of behaviour, with the model explaining 25% (adjusted $R^2 = .24$) of the variance in participants' sun safe practices. To ensure the independent influence of beliefs, a HMR with the demographic factors entered at Step 1 and the critical beliefs entered at Step 2 revealed the same pattern of results, with age (older adults more likely to sun protect) identified as the only significant demographic factor in the final step of the model ($\beta = 0.17, p = <.001$). This final model controlling for the demographic factors at Step 1 explained 30% (adjusted $R^2 = .28$) of the variance in participants' sun-protective behaviour (see Figure 1).

Discussion

Using a TPB approach we aimed to identify the critical sun-protective beliefs of Australian adults. We found that a range of behavioural, normative, and control beliefs significantly correlated with people's sun-protective behaviour, with no and minimal differences observed in correlations between the sun protection beliefs and behaviour by gender and age, respectively. These findings are not surprising given that other TPB studies have shown belief invariance across demographic factors such as gender and age [43]. We revealed also important information about the critical beliefs that guide people's sun-protective practices and that these beliefs remained independent predictors of people's sun safe behaviour over and above background demographics, with age (older adults more likely to sun protect) identified as the only significant demographic factor in the final model. The TPB belief-based framework (not controlling for demographic factors) explained 25% of the

variance in people's sun-protective behaviour which is somewhat higher than other studies investigating beliefs on young adults' sun safe practices [31]. The current study fills an empirical gap in the sun safety literature by investigating an at-risk population for sun exposure and skin cancer and using a well-validated theoretical framework to identify the critical beliefs that guide Australian adults' sun protection behaviour, a topic that is timely given current attention to sun safety and both Vitamin D deficiency [8] and media images of tanning [9]. At least in the present study, beliefs about Vitamin D deficiency did not emerge as critical in determining people's behaviour. Beliefs about being less likely to tan as a consequence of practicing sun safety, however, emerged as a critical belief influencing people's decisions, suggesting that issues surrounding the value of tanning should be examined further.

Our results provide the basis for the beliefs to target in resultant intervention work aimed at combating people's lack of engagement in sun-protective behaviours. First, in examining the behavioural beliefs, our findings suggest that there should be a focus on addressing beliefs about tanning. Bränström *et al.* [28] found that positive attitudes toward tanning are associated with a decreased likelihood of using recommended protection from the sun. Concurring with Bränström *et al.*'s findings, we found that the perception of being less likely to tan as an outcome of engaging in sun protection was the only behavioural belief to independently predict people's sun safe behaviour. It should be noted that the limited association of behavioural beliefs with sun protecting is not surprising given that previous research has also found these beliefs to be limited in predicting people's sun-protective behaviour [31].

Our findings suggest also that normative beliefs are associated with sun-protective behaviour. Unlike previous research which has identified a range of social influences as important to young adults' sun safe behaviour [31, 32], we found that the approval of friends,

in particular, is important in informing adults' sun safe practices. Friendship groups have been shown to be an important source of influence for young adults' health behaviour decision making including their sun safe behaviour [30]. What is noteworthy, from our findings, is that this group remains a main reference point/source of approval for sun safe practices among a general sample of adults. Drawing on the results of this study and that of previous literature, to improve people's engagement in sun-protective behaviours, intervention programs should concentrate their efforts on highlighting the approval of one's friends for being sun safe for adults of all ages. To facilitate change within friendship networks, there may be some benefit in group-targeted (e.g., workplace, sporting club) interventions or to design strategies that require discussion with or endorsement from close friends.

Finally, inspection of the control beliefs revealed those inhibitor beliefs about forgetfulness and inconvenience, and motivator beliefs about knowing that I will be in the sun for a long time and more fashionable hats and sun protective clothing were significant independent predictors of people's sun-protective behaviour. These findings concur somewhat with previous research that has identified a range of control beliefs as influencing young adults' sun safe behaviours [31, 32]. Interestingly, however, is that where a wide range of motivators and inhibitors are identified as being important to young adults' sun safe practices including beliefs about fashion and forgetfulness [31], it is these latter beliefs and beliefs about time being spent in the sun and inconvenience that are the most important motivators and inhibitors for adults in general. It is likely that the demands of everyday adult life (e.g., work, family commitments) can often result in people leading very busy lives and, thus, the simple act of remembering to sun protect may be overlooked and the inconvenience of performing these acts (e.g., finding a hat, time to put on sunscreen) may be heightened. It is important, then, for health promotion messages to highlight the ease in which sun-

protective behaviours can be performed and for policy and community organizers to make sun safe measures readily available where possible.

To overcome people's forgetfulness and facilitate their foresight into the time that they will be out in the sun, it may be useful to encourage making plans to sun protect [44]. Making detailed plans (i.e., when, where, and how an intended behaviour is to be performed) connects the individual with good opportunities to act as the critical situation becomes highly accessible and, thus, easily identifiable when encountered later. This process enables the behaviour to be performed automatically without requiring the effort and attention of the individual [45]. For instance, having an already prepared 'outside activities' bag filled with the appropriate sun safety resources (e.g., hat, sunscreen, long sleeved shirt) which is located conveniently by the door or in the car, may combat some of the identified barriers to behavioural performance. Further, to improve motivations toward sun protection, it may be beneficial to engage and challenge organizations responsible for producing sun-protective clothing to produce more fashionable and attractive items suitable for adult use.

While the research has a number of strengths including the examination of an at-risk population for skin cancer, having a large representative sample and using a well established theoretical approach to identify critical sun protection beliefs, the current study also has a number of limitations. First, we used self-report data which might facilitate socially desirable responses. In addition, behaviour was assessed on a single-item self-report measure.

Although self-report measures are commonly used to assess sun-exposure, they may be subject to bias [46]. More recent research, however, supports the validity of self-reports of exposure to solar UV radiation compared to objectively measured exposure [47]. Further, having an overall measure of sun-protective behaviour in which all possible sun protection methods are incorporated in the one item may also limit the study's findings as the beliefs and actions of people for each individual behaviour may have varied. It is recommended that

future research examine each of the sun protection behaviours separately so that the specific actions which are employed by individuals can be more readily identified. Finally, this study provides the basis for the variables to target in resultant intervention work and future research should test the efficacy of interventions targeting these identified beliefs in actually changing people's sun-protective behaviours. It may also be beneficial when designing interventions targeting these beliefs to tailor a few messages based on age, such as younger adults receiving continual reminders to be sun safe via methods such as iPhone apps. Overall, our findings, which may be generalisable to other countries with similar high UV risk exposure and infrastructure to combat such risk (e.g., shade sails in parks) suggest that attention to addressing people's attitudinal beliefs about tanning, considering the social approval of friends, and tackling the barriers to sun protection may assist in promoting more regular performance of sun safety measures, thereby combating the increasing rates of skin cancer for adults.

Funding

This work was supported by the Australian Research Council [Project ID: LP0991856]; and the Cancer Council Queensland. The funding bodies had no role in the study design; in the collection, analysis, and interpretation of data; in the writing of the manuscript; or in the decision to submit the manuscript for publication.

References

1. Australian Institute of Health and Welfare. *Cancer incidence projections, Australia 2011-2020*. Canberra: Australian Institute of Health and Welfare, 2012. (Cancer series 66, Cat. No. CAN 62).
2. Australian Institute of Health and Welfare & Australasian Association of Cancer Registries. *Cancer in Australia: an overview, 2010*. Canberra: AIHW, 2010. (Cancer series no. 60. Cat. no. CAN 56).
3. Lucas RM, McMichael A, Smith W *et al*. Solar ultraviolet radiation. Global burden of disease from solar ultraviolet radiation. In: Pruss-Ustun A, Zeeb H, Mathers C, Repacholi MH (eds). *Environmental Burden of Disease, Series No 13*. Geneva: World Health Organization, 2006.
4. Cancer Council Australia. *Be SunSmart*. 2011. Available at:
http://www.cancer.org.au/File/HealthProfessionals/Factsheets/FS_SunSmart.pdf.
 Accessed: 21 November 2011.
5. Cancer Council of South Australia. *National Sun Protection Survey 2006–07*. 2008.
 Available from:
www.cancersa.org.au/cms_resources/media/Survey_Summary0607.pdf . Accessed:
 21 November 2011.
6. Kasparian NA, McLoone JK, Meiser, B. Skin cancer-related prevention and screening behaviours: a review of the literature. *J Behav Med* 2009; **32**: 406-428.
7. Stanton WR, Janda M, Baade PD *et al*. Primary prevention of skin cancer: a review of sun protection in Australia and internationally. *Health Promot Int* 2004; **19**: 369-378.
8. Youl PH, Janda M, Kimlin M. Vitamin D and sun protection: the impact of mixed public health messages in Australia. *Inter J Cancer* 2009; **124**: 1963–1970.

9. Dixon H, Dobbinson S, Wakefield M *et al.* Portrayal of tanning, clothing fashion and shade use in Australian women's magazines, 1987–2005. *Health Educ Res* 2008; **23**: 791–802.
10. Dobbinson S, Wakefield M, Hill D *et al.* Prevalence and determinants of Australian adolescents' and adults' weekend sun protection and sunburn, summer 2003-2004. *J Am Acad Dermatol* 2008; **59**: 602-614.
11. Murray CD, Turner E. Health, risk and sunbed use: A qualitative study. *Health Risk Soc* 2004; **6**: 67-80.
12. Young RA, Logan C, Lovato CY *et al.* Sun protection as a family health project in families with adolescents. *J Health Psychol* 2005; **10**: 333–44.
13. Lupton D, Gaffney D. Discourses and practices related to suntanning and solar protection among young Australians. *Health Educ Res* 1996; **11**: 147–59.
14. Shoveller JA, Lovato CY, Young RA *et al.* Exploring the development of sun-tanning behavior: a grounded theory study of adolescents' decision making experiences with becoming a sun tanner. *Int J Behav Med* 2003; **10**: 299–314.
15. Jackson KM, Aiken LS. Evaluation of a multicomponent appearance-based sun-protective intervention for young women: Uncovering the mechanisms of program efficacy. *Health Psychol* 2006; **25**: 34-46.
16. Hevey D, Pertl M, Thomas K *et al.* Body consciousness moderates the effect of message framing on intentions to use sunscreen. *J Health Psychol* 2010; **15**: 553-559.
17. Myers LB, Hornswill MS. Social cognitive predictors of sun protection intention and behaviour. *Behav Med* 2006; **32**: 57-63.
18. Becker, MH, Haefner, DP, Kasl, SV *et al.* Selected psychosocial models and correlates of individual health-related behaviors. *Med Care* 1977; **15**: S27-S46.

19. Prochaska, JO, DiClemente, CC. Stages and processes of self-change of smoking:
Toward an integrative model of change. *J Consult Clin Psychol* 1983; **51**: 390-395.
20. Bandura A. *Social foundations of thought and action: A social cognitive theory*.
Englewood Cliffs, NJ: Prentice-Hall, 1986.
21. Ajzen I. The theory of planned behavior. *Organ Behav Hum Dec* 1991; **50**: 179-211.
22. Conner M, Sparks P. Theory of planned behavior and health behaviors. In
Conner M, Norman P (eds.). *Predicting health behaviour: research and practice with
social cognitive models*. Buckingham, England: Open University Press, 2005, 170.
23. Fishbein M, Von Haeften I, Appleyard J. The role of theory in developing effective
interventions: implications from Project SAFER. *Psychol Health Med* 2001; **6**: 223-
238.
24. Hardeman W, Johnston M, Johnston DW *et al*. Application of the theory of planned
behaviour in behaviour change interventions: a systematic review. *Psychol Health*
2002; **17**: 23-158.
25. Garside R, Pearson M, Moxham T. What influences the uptake of information to prevent
skin cancer? A systematic review and synthesis of qualitative research. *Health Educ
Res* 2010; **25**: 162–82.
26. Queensland Health: Pollard G, White D, Harper C. *Self-Reported Health
Status: Queensland. 2009 Survey Report*. Brisbane: Queensland Health, 2009.
27. Thomas K, Hevey D, Pertl, M *et al*. Appearance matters: The frame and focus of health
messages influences beliefs about skin cancer. *Brit J Health Psych* 2011; **16**: 418-429.
28. Bränström R, Ullén H, Brandberg Y. Attitudes, subjective norms and perception of
behavioural control as predictors of sun-related behaviour in Swedish adults. *Prev
Med* 2004; **39**: 992-999.

29. Pertl M, Hevey K, Thomas A *et al.* Differential effects of self-efficacy and perceived control on intention to perform skin cancer-related health behaviours *Health Educ Res* 2010; **25**: 769-779.
30. White KM, Robinson NG, Young RMcD *et al.* Testing an extended theory of planned behaviour to predict young people's sun safety in a high risk area. *Brit J Health Psych* 2008b; **13**: 435-448.
31. Robinson NG, White KM, Young RM *et al.* Young people and sun safety: the role of attitudes, norms and control factors. *Health Promot J Aust* 2008; **19**: 45-51.
32. White KM, Robinson NG, Young, RMcD *et al.* Exploring young people's beliefs and images about sun safety. *Youth Stud Aust* 2008a, **27**: 43-49.
33. Audrain-McGovern J, Hughes C, Patterson F. Effecting behaviour change: awareness of family history. *Am J Prev Med* 2003; **24**:183-198.
34. McClendon BT, Prentice-Dunn S, Blake R *et al.* The role of appearance concern in response to intervention to reduce skin cancer risk. *Health Educ* 2002; **102**: 76–83.
35. Sutton S. Using social cognitive models to develop health behaviour interventions: Problems and assumptions. In: Rutter D, Quine L (eds). *Changing health behaviour*. Buckingham: Open University Press; 2002, Chapter 11.
36. Weinstein ND. Misleading tests of health behavior theories. *Ann Behav Med* 2007; **33**: 1-10.
37. Gagne C, Godin G. The theory of planned behavior: Some measurement issues concerning belief-based variables. *J Appl Soc Psychol* 2000; **30**: 2173-2193.
38. Australian Bureau of Statistics. *2006 Census quickstats*. Available from www.abs.gov.au. Accessed: 18 April 2012.
39. Fishbein M, Ajzen I. *Beliefs, attitude, intention and behavior: an introduction to theory and research*. Reading, MA: Addison-Wesley, 1975.

40. Hill CE, Thompson BJ, Williams EN. A guide to conducting consensual qualitative research. *Couns Psychol* 1997; **25**: 517–572.
41. von Haefen I, Fishbein M, Kasprzyk D *et al.* Analyzing data to obtain information to design targeted interventions. *Psychol Health Med* 2001; **6**: 151-164.
42. Jones F, Harris P, Chrispin C. Catching the sun: an investigation of sun-exposure and skin protective behaviour. *Psychol Health Med* 2000; **5**: 131-141.
43. Rhodes RE, Blanchard CM, Blacklock RE. Do physical activity beliefs differ by age and gender? *J Sport Exercise Psy* 2008; **30**: 412-423.
44. Schwarzer R, Luszczynska A. How to overcome health-compromising behaviors: the health action process approach. *Eur Psychol* 2008; **13**: 141-151.
45. Orbell S, Hodgkins S, Sheeran P. Implementation intentions and the theory of planned behavior. *Pers Soc Psychol B* 1998; **23**: 945-954.
46. Glanz K, Mayer JA. Reducing ultraviolet radiation exposure to prevent skin cancer methodology and measurement. *Am J Prev Med* 2005; **29**: 31-142.
47. Glanz K, Gies P, O'Riordan DL *et al.* Validity of self-reported solar UVR exposure compared to objectively measured UVR exposure. *Cancer Epidem Biomar* 2010; **19**: 3005-3012.

Table 1. Means, Standard Deviations, and Correlations for Sun Safe Beliefs with Behaviour for the Total Sample and Correlations between Sun Safe Beliefs with Behaviour by Gender and Age Group

Sun Safe Beliefs	Mean (SD)	Behaviour (r) Total (<i>n</i> = 816)	Behaviour (r)			Behaviour (r)		
			Men (<i>n</i> = 283)	Women (<i>n</i> = 296)	Fisher's <i>Z</i>	Younger adults (<i>n</i> = 317)	Older adults (<i>n</i> = 262)	Fisher's <i>Z</i>
Behavioural Beliefs								
Look unfashionable when performing sun safe behaviours	3.49(1.82)	-.04	-.03	-.07	-.48	-.10	.07	-2.04*
Have “hat hair” if I wear a hat	4.46(2.08)	.04	.00	.02	-.24	-.01	.13*	-1.7
Decrease the risk of skin cancer	6.33(1.14)	.12**	.15*	.05	1.21	.08	.19**	-1.39
Be less affected by glare if I wear sun glasses	6.38(1.18)	.14**	.15*	.11	.49	.12*	.18**	-.66
Protect my eyes by wearing sun glasses	6.34(1.20)	.10**	.12	.06	.72	.13*	.10	.31
Be uncomfortable	4.71(1.69)	-.12**	-.14*	-.12*	-.24	-.18**	-.03	-1.8
Decrease the risk of sunburn	6.24(1.26)	.15***	.15*	.14*	.12	.08	.22***	-1.74
Be less likely to tan	5.21(1.71)	.14**	.15*	.14*	.12	.07	.20***	-1.51
Not get enough Vitamin D	3.44(1.88)	.04	.05	.02	.36	.02	.01	.12
Be exposed to harmful chemicals if I use SPF30+ sunscreen	2.95(1.83)	.09*	.12	.05	.84	.09	.04	.57
Normative Beliefs								
Mum	5.49(1.75)	.17***	.15*	.17*	-.22	.15**	.26**	-1.1

Dad	4.96(1.86)	.19***	.16*	.20**	-.41	.13*	.37***	-2.31*
Spouse	5.56(1.60)	.17**	.21**	.15*	.62	.16*	.16*	-.01
Other family members	5.12(1.59)	.27***	.27***	.24***	.36	.18**	.37***	-2.23*
Friends	4.78(1.59)	.32***	.29***	.32***	.39	.25***	.33***	-.94
Health care professionals	6.46(1.20)	.08	.09	.07	.23	-.00	.20**	-2.27*
Control Beliefs								
Forgetfulness	4.70(1.81)	-.30***	-.24***	-.34***	1.31	-.24***	-.33***	1.23
Sun safe measures unavailable	3.41(1.82)	-.14**	-.10	-.19**	1.10	-.14*	-.10	-.43
Laziness	4.65(1.83)	-.32***	-.31***	-.31***	0	-.26***	-.33***	.98
Inconvenience	4.68(1.76)	-.31***	-.28***	-.33***	.66	-.25***	-.34***	1.17
Cold or overcast weather	4.98(1.67)	-.19***	-.12	-.24***	1.48	-.17**	-.19**	.23
Thinking I won't be out in the sun	5.20(1.57)	-.18***	-.13*	-.23***	1.24	-.20***	-.08	-1.43
Not having enough time	4.33(1.81)	-.21***	-.14*	-.29***	1.88	-.14**	-.24***	1.28
Hot or humid weather	3.46(1.96)	-.21***	-.18**	-.24***	.75	-.21***	-.21**	0
Sun safe measures available	5.35(1.65)	.07	.11	.04	.84	.11*	.04	1.8
Having continual reminders to be sun safe	4.82(1.70)	.18***	.21***	.14*	.86	.22***	.07	3.49***
Knowing that I will be in the sun for a long time	6.35(1.03)	.18***	.16**	.17**	-.12	.18**	.16**	.16
Feeling or seeing signs of sunburn	6.26(1.15)	.08*	.10	.04	.72	.08	.08	-.06
User-friendly sunscreen	5.97(1.34)	.12**	.07	.14*	-.85	.17**	.07	1.25
More fashionable hats and sun protective clothing	4.96(1.81)	.21***	.23***	.13*	1.24	.17**	.24***	-.76

Cheaper sun safe products	5.32(1.66)	.12**	.16**	.05	1.33	.12*	.12	.02
Others using sun safe measures	4.98(1.62)	.15***	.14*	.13*	.12	.18**	.09	1.08
Demographic Factors								
Age	39.7(15.94)	.27***						
Male vs female	-	.10*						
Time spent in sun (typical) weekday	2.20(2.23)	-.01						
Time spent in sun weekend	3.92(3.34)	.01						
Skin type	-	-.07						
Employment status	-	.03						
University education	-	-.08						
City living		.10*						
Behaviour	4.73(1.68)							

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, two-tailed. Younger adults = 18-39 years; Older adults = 40 years and over.

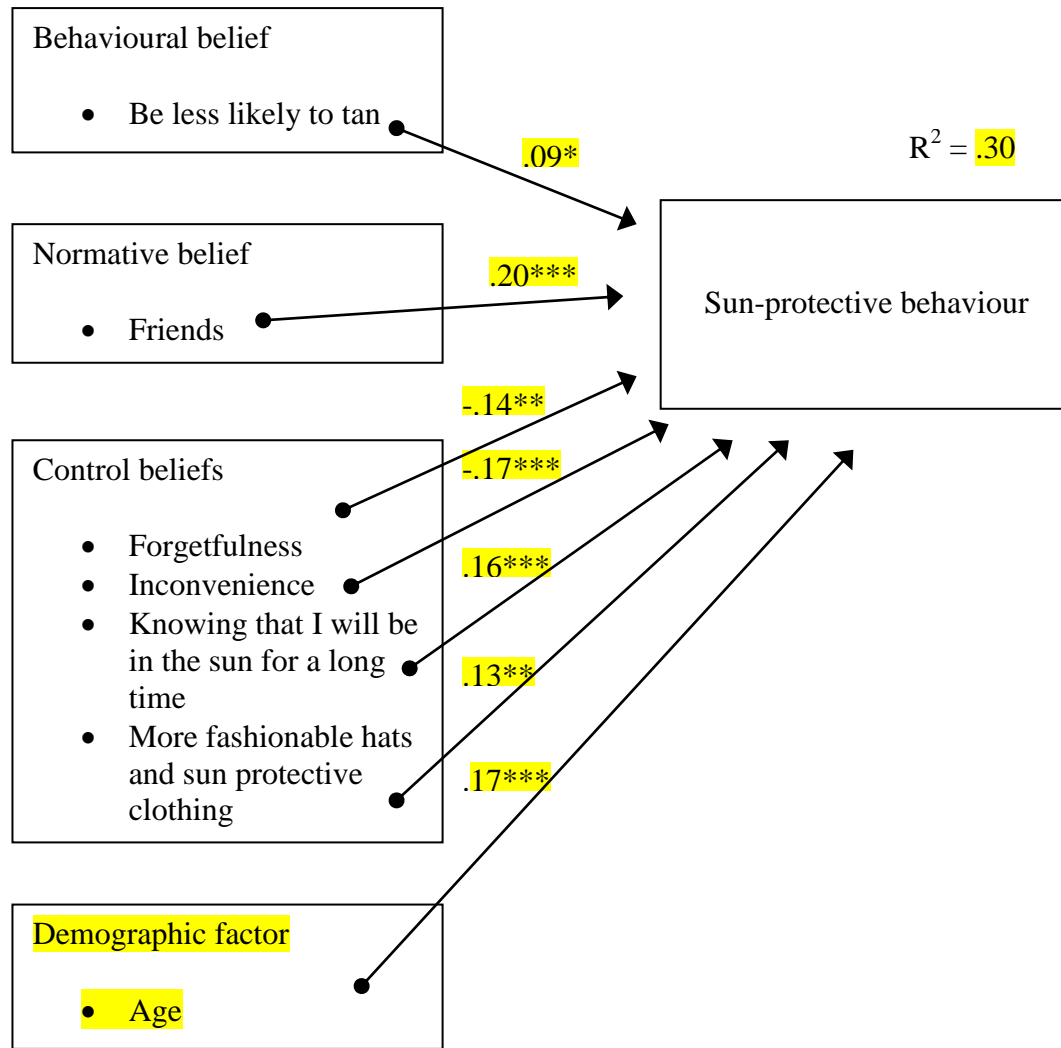


Figure 1. Final model based on a HMR analysis with demographic factors entered at Step 1 and critical beliefs entered at Step 2 (N = 516).

Note. R = .55, Adjusted R² = .28, Standard Error of the Estimate = 1.40.

* $p < .05$. ** $p < .01$ *** $p < .001$.